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Technical Reference—

Using the E-P Plus Control on HxJ, TxJ, and 30-inch VxJ Model Washer-Extractors

PELLERIN MILNOR CORPORATION POST OFFICE BOX 400, KENNER, LOUISIANA 70063 - 0400, U.S.A.

Applicable Milnor® products by model number:

30022H7J 30022H8J 30015T5J 30022T5J 30015V7J 30022V6J

Preface

i. About This Manual

Document BIRHUK02
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i. 1. Scope

This manual provides commissioning, programming, operating, and troubleshooting instructions for Milnor® washer extractors equipped with the Milnor® E-P Plus® microprocessor control. See the installation manual for information on machine installation procedures and mechanical requirements. See the service manual for preventive maintenance, service procedures, and mechanical parts identification. See the schematic manual for electrical parts identification and electrical troubleshooting instructions.

i. 2. The Normal Display at Start-up

The start-up display sequence for models using the E-P Plus® controller is described in the document BICJHO01, entitled "Running a Formula." Use the table of contents for this manual to locate this document.

i. 3. How To Identify This Manual and Its Included Documents [Document BIUUUD13]

A complete identification of this manual or any document in this manual must include **all** specifications shown on the front cover, as defined below:

Published manual number—Primary identification number for the manual or any variation of it.

Specified date—The approximate date of introduction of the product or product change this manual covers.

As-of date—When a manual for an old product is generated, any new information about the old product developed up to this date will be included in the manual.

Access date—The date the manual was generated (assembled and formatted).

Applicability—Code(s) that represent a group of machines this manual applies to and/or actual model numbers of applicable machines. The complete list of applicable models is provided inside the front cover.

When referring to any **document** used in this manual (as identified by an eight-character document number such as BIUUUD13 at the start of the document), a complete identification of the document must include all specifications shown on the front cover, except substituting the document number for the published manual number.

i. 4. Trademarks of Pellerin Milnor Corporation [Document BIUUUD14]

The following, some of which may be used in this publication, are trademarks of Pellerin Milnor Corporation:

Table 1: Trademarks

Ampsaver®	CBW®	Gear Guardian®	Milnet®	Staph-Guard®
Autolint®	Dye-Extractor®	Hands-Off®	Milnor®	System 4®
Auto-Purge®	Dyextractor®	Hydro-Cushion®	Miltrac	System 7®
Autovac	E-P Plus®	Mildata®	Miltron	Totaltrol

— End of BIRHUK02 —

Contents

Sections	Figures, Tables, and Supplements
Preface	
i. About This Manual (Document BIRHUK02)	
i.1. Scope	
i.2. The Normal Display at Start-up	
i.3. How To Identify This Manual and Its Included Documents (Document BIUUUD13)	
i.4. Trademarks of Pellerin Milnor Corporation (Document BIUUUD14)	Table 1: Trademarks
Table of Contents	
Chapter 1. Commissioning	
1.1. Important Owner/User Information (Document BIRHUK01)	
1.1.1. Ensure Safety of All Laundry Personnel	
1.1.2. Customize Data	
1.1.2.1. When to Customize Data	
1.1.2.2. What Customizing Requires	
1.1.2.3. Data Accessibility	Table 2: Data Use and Alteration
1.1.2.4. If Data Becomes Corrupted	
1.2. Determining Load Size (Document BIWUUO01)	
1.3. Important Instructions for Pumped Chemical Inlets (Document BIWUUI01)	
1.3.1. How Pumped Chemical Systems Can Internally Damage the Washer-extractor	Supplement 1: Preventing Dribbling by Purging Chemical Lines
1.3.2. Locating Chemical System Components to Reduce the Risk of Internal Damage	Figure 1: Proper Routing of Chemical Tubing
1.3.3. Preventing Leaks Which Can Injure Personnel and Cause External Damage	Figure 2: Proper Chemical Tubing Connection Locations
1.4. Connecting Chemical Systems (Document BICJFI01)	Supplement 2: Maximizing Chemical Injection Precision
1.4.1. Available Chemical Injection Methods	
1.4.1.1. Chemical Injection Output Signals	
1.4.1.2. Optional Five-Compartment Flushing Chemical Injector	
1.4.1.3. Liquid Chemical Tube Barbed Connectors	
1.4.2. Considerations for Pumped Chemical Systems	
1.4.3. Connecting Devices to Receive Injection Signals	

Sections	Figures, Tables, and Supplements

1.4.4. Connecting Chemicals to 30-inch HxJ Models

Table 3: Chemical Injection Signals for HxJ Models

Chapter 2. Programming

2.1. Controls on E-P Plus Washer-extractors (Document BICJHC01)

Figure 3: Typical Control Panel on 30015 and 30022 E-P Plus Models

2.1.1. Control Functions During Normal Operation

2.1.2. Control Functions During Manual Operation

2.1.3. Control Functions During Programming

2.2. Selecting an Industry Formula Set (Document BICJHC02)

Figure 4: Location of DIP Switches

Table 4: DIP Switch Settings for Industry Configurations

2.3. Programming the E-P Plus Controller (Document BICJHP01)

2.3.1. How to Avoid Data Loss

2.3.2. Return to Run Mode (Option 0)

2.3.3. Add or Change a Formula (Option 1)

2.3.3.1. About the Programming Help Screens

2.3.3.2. Moving Forward and Backward through Steps and Decisions

2.3.3.2.1. Actions when the Cursor is at the Step Number

2.3.3.2.2. Actions when the Cursor is at a Decision within a Step

2.3.3.3. Create a New Formula

2.3.3.4. Delete an Existing Formula

2.3.3.5. Change an Existing Formula

2.3.3.5.1. How to Insert or Delete a Step in an Existing Formula

2.3.3.5.2. The Step Decisions

2.3.3.5.3. How to Modulate Water Valves to Regulate Incoming Water Temperature

2.3.3.5.4. How to Use Cooldown

2.3.3.5.5. How to Select the Bath Level

2.3.3.5.6. How to Select the Steam Code

2.3.3.5.7. Injecting Chemicals

Table 5: Codes for Inject Times of 100 Seconds and Longer

2.3.3.5.8. How to Save or Discard Changes

2.3.4. Configure the Control (Option 2)

2.3.4.1. Moving Forward and Backward in Configure

2.3.4.2. The Configure Decisions

2.3.5. Restoring Standard E-P Plus Formulas (Document BICJUP01)

Chapter 3. Operating

Sections	Figures, Tables, and Supplements

3.1. Running a Formula (Document BICJHO01)
3.1.1. Applying Power
3.1.2. Selecting and Starting the Formula
3.1.2.1. Load Machine and Close Door
3.1.2.2. Selecting a Formula
3.1.3. Unloading the Machine
3.1.4. The Display during Automatic Operation
3.1.5. How to Shorten, Terminate, or Suspend a Running Formula
3.1.6. How to Restart after Power Loss
3.1.7. How the Flush Valve Works
3.1.8. How Cooldown Works

3.2. Viewing and Clearing the Formula Count Accumulator (Document BICJUD01)

Chapter 4. Troubleshooting

4.1. The EP-Plus Manual Menu (Document BICJHT02)
4.1.1. The Manual Menu
4.1.1.1. Components
4.1.1.2. How to Access the Manual Menu
4.1.1.3. How to Return to the Run Mode from the Manual Menu
4.1.2. Determining the Software Version
4.1.3. Viewing Microprocessor Inputs — Table 6: E-P Plus Inputs
4.1.4. Actuating Microprocessor Outputs — Table 7: E-P Plus Outputs
4.1.5. Testing and Verifying the DIP Switch Settings — Figure 5: HxJ Processor Board; Table 8: Interpretation of Test DIP Switch Display
4.1.6. Testing Temperature and Level Sensors

4.2. Error Messages (Document BICJHT01)
4.2.1. Error Messages at Power Up
4.2.2. Error Messages during Normal Operation

Chapter 5. Supplemental Information

5.1. The E-P Plus Hardware (Document BICJUF01)
5.1.1. Keyswitches
5.1.1.1. Run/Program Keyswitch
5.1.1.2. Automatic/Test Keyswitch
5.1.2. Display
5.1.3. Power Supply

Sections	Figures, Tables, and Supplements

5.1.4. CPU Processor Board
5.1.5. Outputs
5.1.6. Option Outputs
5.1.7. Analog to Digital Convertor
5.1.8. Temperature Probe
5.1.9. Pressure Sensor

Chapter 1
Commissioning

1.1. Important Owner/User Information

Document BIRHUK01
Spec Date 20000831
As-of Date 20000831

The following two procedures must be completed before this machine is placed in service:

1. Ensure the safety of all laundry personnel.
2. Customize the data contained in the memory of the machine (configuration, formulas, and productivity/formula accumulator data).

1.1.1. Ensure Safety of All Laundry Personnel

Ensure that all personnel who will operate or maintain this machine read the safety manual before permitting them to access the machine. Ensure that all user manuals are available to the appropriate personnel and that all precautions explained in all applicable manuals are observed.

1.1.2. Customize Data

Customizing the data includes verifying that the controller is configured for the particular application, modifying certain wash programs if necessary for optimum productivity, and verifying that the formula count accumulator is cleared so the formula count will be accurate.

1.1.2.1. When to Customize Data

- When commissioning the machine
- When required by error message
- After replacing the microprocessor board
- After upgrading the software
- After adding or removing optional equipment

1.1.2.2. **What Customizing Requires**—Verify configuration. Program formulas and clear productivity data, if applicable. See the programming and operating sections in this manual for instructions.

1.1.2.3. **Data Accessibility**—Configuration and formula data can only be altered while the keyswitch is in the *Program* position (data is protected by the keyswitch). Productivity data, because it is accumulated in the *Run mode*, cannot be protected by the keyswitch and is accessible to anyone. Data is accessible to the extent described in Table 2.

Table 2: Data Use and Alteration

Data Type	How Data can be Used and Altered
Configuration Data	Data can be read and written over
Formula Data	Data can be read, written over (added to/changed) and cleared
Productivity Data	Data can be read and cleared

1.1.2.4. **If Data Becomes Corrupted**—If the microprocessor senses that data is unusable or unreliable, an error message will appear—usually at power-up—possibly preventing machine operation. The consequences and appropriate actions for each error message are explained in the troubleshooting instructions. Follow these instructions exactly to ensure that corrupt data is completely eliminated and replaced with valid data. Failure to do so may result in unsafe operation or machine damage.

— End of BIRHUK01 —

1.2. Determining Load Size

Document BIWUUO01
Spec Date 20000831
As-of Date 20000831

Putting **too much** linen into a properly designed laundry washer-extractor will not **overload** the machine to its mechanical or electrical detriment if these guidelines are followed:

1. The goods consist of typical cotton and/or synthetic fabrics normally encountered in commercial laundering operations.
2. The load is not so bulky as to prevent a reasonably balanced distribution prior to the onset of extraction.
3. The extract speed has not been increased above the designed maximum.
4. The total number of intermediate and final extractions do not exceed the designed maximum for the extract motor.

Thus, the *maximum soiled linen capacity* for any properly designed washer-extractor is essentially limited by the amount of soiled goods that can actually be placed in the cylinder.

The maximum weight of soiled goods that a washer-extractor cylinder will accept depends on the following factors:

- the internal volume of the cylinder (the space into which the goods can be placed), and
- the density (weight and bulkiness) of the specific goods

For example, many polyester-cotton fabrics have relatively low weights for their bulk so one should rarely expect to be able to put in a published maximum capacity load of such fabrics. In fact, published maximum capacities of machines based on the now generally accepted industry standards will usually be achieved only with the highest density, closely woven fabrics and a reasonable soil content.

The best load size depends on the size of the machine—plus the type of goods, soil content, and wash quality desired. Since the latter factors vary considerably, prior experience and/or experimentation generally yield the best results. Use these guidelines:

1. Overloading a washer-extractor will not increase production because longer wash formulas and more rewash will be required.
2. Avoid underloads because the inevitable greater extraction imbalance will cause more extract re-cycles and may stress the machine unnecessarily.
3. Load divided cylinder machines so that the **weight in each compartment is approximately equal at the onset of extraction.** Do not put goods with grossly dissimilar water absorption characteristics in the different compartments. Do not attempt to balance loads of wet goods in one compartment against dry goods in the other.

— End of BIWUUO01 —

1.3. Important Instructions for Pumped Chemical Inlets

Document BIWUUI01
Spec Date 20000831
As-of Date 20000831

1.3.1. How Pumped Chemical Systems Can Internally Damage the Washer-extractor

Many pumped liquid chemical systems dribble concentrated chemicals out of the injection tubes when the system is not used for relatively long periods of time—as after working hours and during weekends. This puts highly concentrated corrosive chemicals in direct contact with dry stainless steel surfaces, and often directly on any textiles left in the machine. **Chemical deterioration (rusting) of the stainless steel and damage to the textiles is the inevitable result.**

Pellerin Milnor Corporation accepts absolutely no responsibility whatsoever for damage to its equipment or to any textiles therein when concentrated chemicals dribble out of the injection tubes onto any part of the machine or its contents.

Supplemental Topic 1

Preventing Dribbling by Purging Chemical Lines

Although the injection site is flushed by washer agitation on some models and after each injection on other models to aid the injection process, this flushing provides absolutely no protection against harmful dribble which occurs later—when the machine is no longer in use.

One foolproof solution for "dribbling" is to completely purge the appropriate chemical injection tube with fresh water after every injection, so that only fresh water (which cannot cause a problem) can dribble out.

Obviously, it is the sole responsibility of the pump and/or chemical supplier (not the machine manufacturer) to furnish such a flushing device. (We understand that such flushing type chemical injection systems—both for retrofit to existing systems and for new installations—are now offered by others.)

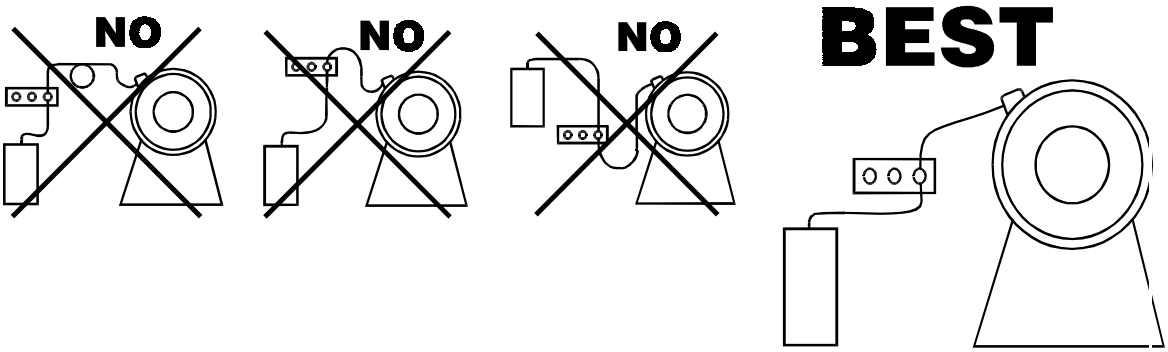
1.3.2. Locating Chemical System Components to Reduce the Risk of Internal Damage

If the tubes, pumps, and chemical tanks are kept well below the injection point, the likelihood of "after-hours dribbling" is reduced, but not totally eliminated.

We therefore urge that tubes from any non-flushing pumped chemical system be connected as shown in Figure 1. Although fresh-water flushing the just-used tubes after each injection

would be better, we believe routing the tubes as indicated will probably minimize the dribbling effect about as much as possible without flushing. Never permit tanks, pumps, or any portion of the tubes to be higher than the injection point. If loops in the injection tubes are employed, make sure the entire loop is well below the injection point.

Figure 1: Proper Routing of Chemical Tubing



Note 1: As shown in Figure 1, all tanks, pumps, and tubing must be lower than the injection point on the machine and must not dribble chemicals into the machine, nor leak chemicals externally onto any portion of the machine or its surroundings.

1.3.3. Preventing Leaks Which Can Injure Personnel and Cause External Damage

All ports on the inlet are plugged at the Milnor® factory. When replacing plugs with fittings or when reinstalling plugs, always use the sealant furnished (LocTite RTV Silicone Adhesive or equivalent). Use properly sized hose barbs, always use clamps, and check for leaks. Use the hose barbs furnished with your machine only if they provide the proper fit for the tubes employed. Ensure that excessive pressures cannot build up that might burst or disconnect tubing. Instruct the operator to monitor for leaks and report any occurences.

When calibrating injections, it is permissible to remove tubes from barbed fittings to take samples. However, always check for leaks after installing tubes and clamps. A preferable method is to install a three-way or two two-way valves onto each injection tube for sampling.

WARNING 1: Avoid chemical burns and corrosion—Concentrated liquid chemicals leaking from a chemical system can burn skin and eyes, cause other types of injury or illness, and corrode machine components.

- Ensure that excessive pressures cannot build up which might burst or disconnect a chemical delivery tube.
- Ensure that there are no external chemical leaks when the system is installed or calibrated.
- Periodically check the system for leaks during operation.

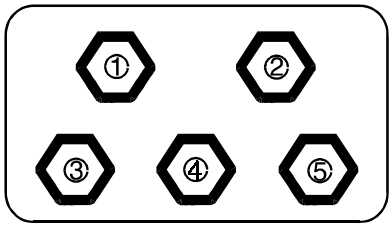
CAUTION 2: Avoid corrosion and textile damage—Chemicals dribbling into the machine when it is idle will corrode machine components and damage any textiles left in the machine.

- If possible, use a system that flushes the entire chemical delivery tube after each injection.
- If a non-flushing system is used, install tanks, pumps, and tubing below the injection point on the machine, such that chemicals travel to the machine at an upward angle.

CAUTION 3: Avoid explosions—Certain chemicals will react when combined.

- Connect chemical inlets as shown in Figure 2.

Figure 2: Proper Chemical Tubing Connection Locations

Front View of Chemical Injection Points	Legend
	**1.** Soap **2.** Softener **3.** Bleach **4.** Starch **5.** Sour

NOTICE [4]: Pellerin Milnor Corporation accepts absolutely no responsibility for damage to its equipment or to any textiles therein when concentrated chemicals dribble out of the injection tubes onto any part of the machine or its contents.

— End of BIWUUI01 —

1.4. Connecting Chemical Systems

Document.....BICJFI01
Spec Date 20000831
As-of Date 20000831

Multiple methods are available on System 7® and E-P Plus® washer-extractors to accommodate chemical systems. Use this section to help determine the best method of chemical injection and how to connect the chemical system. Always consult the schematic manual for this machine before connecting chemical systems to the machine.

DANGER [5]: Electric Shock Hazard—Contact with high voltage electricity will kill or seriously injure you. Even with the Master Switch *off* and/or any Emergency Stop switches *off*, three-phase power and control circuit power are still present at several locations within electric boxes and electrical components.

DANGER [6]: Injury and Damage Hazards—Improper wiring can cause the machine to malfunction, risking injury to personnel, damage to machine components, and damage to goods.

- Electrical and piping connections described in this section must be made only by qualified, authorized personnel.
- Lock off and tag out power at the external disconnect switches for the washer-extractor and for any chemical devices that provide power to the interpret relay box (if furnished) before proceeding.
- Do not rely merely on the information in this section when wiring. Consult all applicable electrical schematics.
- Do not reroute or rearrange any wires not specifically permitted by this instruction.
- Do not connect a common wire to ground. Use the common terminal furnished.

CAUTION [7]: Risk of Poor or Inconsistent Wash Quality—Injection times of less than 10 seconds are discouraged because fine adjustments are not possible and factors such as pump lag time may cause significant variations in the amount of chemical delivered.

- Size pumps or valves small enough for adequate control (i.e., for longer injection times).
- Use two pumps or valves to inject a small or large quantity of the same chemical, if required.

Supplemental Topic 2

Maximizing Chemical Injection Precision

Injection of a consistent amount of chemical is important in controlling wash quality and using chemicals economically. When chemicals are injected by units of time, as is done with most washer-extractors, injections of short duration can be imprecise because of two reasons:

- Fine adjustments to the delivered quantity are not possible. For example, if an injection of three seconds is extended by one second, the quantity delivered is theoretically increased by more than 30 percent. However, if an injection of 20 seconds is increased by one second, the theoretical quantity is increased by only five percent.
- Variations in the time between the start of the chemical signal and the start of the chemical delivery into the machine can cause significant differences in the quantity of chemical injected. In this case, if a pump starts more slowly some times than others, or if the delivery tubes are partially empty at the start of the inject period, the quantity of chemical delivered may vary significantly. As an example, assume a peristaltic pump moves chemical along the delivery tube at a rate of three feet per second. If the delivery tube is empty for three feet along its length, then one second of the injection time is spent injecting air rather than chemical. If the programmed injection time is only three seconds, then one third of the desired chemical is not being delivered. However, if the programmed injection time is 20 seconds, the chemical delivery is only five percent less than desired.

  Increasing the programmed injection time makes any variation less significant. Use pumps and/or valves sized to allow inject times of at least 10 seconds. If injection times for a specific chemical vary widely from one formula to another, consider using two pumps or valves for the same chemical. Actuate one pump for injecting small quantities, and use both pumps or valves for larger quantities.

1.4.1. Available Chemical Injection Methods

1.4.1.1. Chemical Injection Output Signals—Five discrete signals (for chemicals 1 through 5) are furnished standard on all washer extractors. These signals are available at a terminal strip on System 7® and E-P Plus® machines. Check the nameplate on the machine to verify the model.

1.4.1.2. Optional Five-Compartment Flushing Chemical Injector—A five-compartment dry supply injector mounted externally on the washer-extractors is offered optionally. The five electrically operated flush valves are wired to chemical injection output signals at terminal strip TBA.

1.4.1.3. Liquid Chemical Tube Barbed Connectors—A six port inlet is standard on all models. Use these valveless inlets to connect tubes from remote chemical supply injection systems that are not continuously pressurized and that deliver chemicals only when an injection is commanded.

1.4.2. Considerations for Pumped Chemical Systems

Pumped chemical systems deliver chemicals to the machine intermittently usually via peristaltic pumps. Inlets on the machine must be unrestricted at all times (valveless). The five port pumped chemical inlets meet this requirement.

An inherent risk of this method of chemical injection is that concentrated chemicals can dribble into the machine after it is shut down for the evening, causing machine and/or linen damage. Because Milnor® has no control over the design or installation of pumped chemical systems, Pellerin Milnor Corporation accepts absolutely no responsibility for damage to its

equipment or textiles therein caused in this way. Much more information on this subject is provided in document BIWUUI01, "Important Instructions for Pumped Chemical Inlets" (see table of contents). Consult this document before connecting a pumped chemical system.

1.4.3. Connecting Devices to Receive Injection Signals

Injection signals provide a 110VAC/50Hz or 120VAC/60Hz potential. Each signal can accomodate one apparatus not exceeding 37 milliamperes. Inject signals cannot be made potential-free.

CAUTION 8: Avoid Component Damage—Board components will burn out and require board replacement if devices driven by inject signals do not meet the electrical specifications. Pumps generally draw a higher current and will burn out board components.

1.4.4. Connecting Chemicals to 30-inch HxJ Models

Acquire signals at connector TBS near the rear access panel, next to the incoming power connections. See Table 3 for connection details.

Table 3: Chemical Injection Signals for HxJ Models

Signal Component	Chemical	Relay	Processor Board Connection	TBS Terminal Number
Chemical 1	Detergent	CR01M	M5-3	95
Chemical 2	Bleach	CR02M	M5-6	93
Chemical 3	Sour	CR03M	M5-5	91
Chemical 4	Softener	CR04M	M5-4	75
*Chemical 5	Starch	CR05M	M5-2	85
* Chemical 5 is not used if the machine is equipped and configured for ChemSave. In this case, relay CR05M closes whenever the machine desires to inject a chemical.				

— End of BICJFI01 —

Chapter 2
Programming

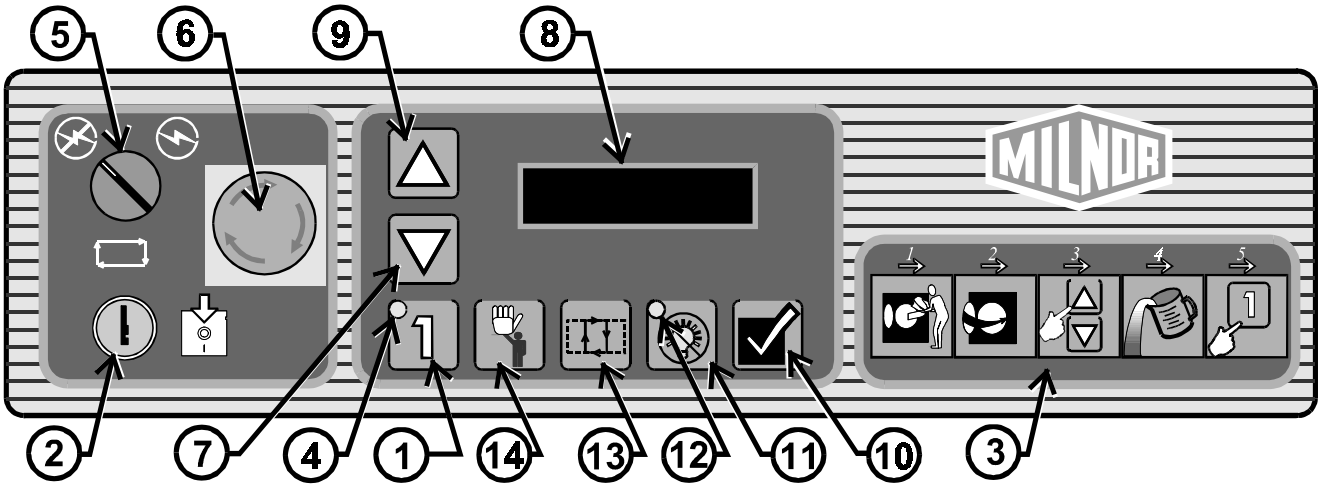
2.1. Controls on E-P Plus® Washer-extractors

Document BICJHC01
Spec Date 20000831
As-of Date 20000831

The controls on these Milnor® washer-extractors are predominantly membrane push-buttons, some of which include indicator lights. Other controls include a keyswitch, a standard emergency stop button, and a two-position rotary switch for main machine power. Some of these controls serve different functions in the three operational modes of the machine. The function of each control in the normal, manual, and programming modes of this machine is described in detail in this document.

Figure 3: Typical Control Panel on 30015 and 30022 E-P Plus Models

Control Panel



Legend

1. Start button
2. Run/Program keyswitch
3. Pictorial Instructions
4. Run Indicator light
5. Master switch
6. Emergency Stop button
7. Scroll Down button
8. Display
9. Scroll Up button
10. Next button
11. Signal Cancel button
12. Operator Signal light
13. Manual Mode button
14. Terminate button

2.1.1. Control Functions During Normal Operation

Normal operation is the state of the machine when the machine control circuit is energized and the Run/Program keyswitch is in the *Run* position. The machine may be either idle (waiting to run a formula) or running. If the machine is idle, the message on the display will begin with "Run Formula" and include a formula number on the second line.

1. Press the *Start button* ([1]) to initiate the selected wash formula. The formula begins if power is available at the machine and the loading door is closed.
2. The *Run/Program keyswitch* must be in the *Run* position ( ) unless the machine is being configured or programmed. All control descriptions listed under section 2.1.1 Control Functions During Normal Operation are based on the keyswitch being in the *Run* position. Refer to section 2.1.3 for descriptions of how the controls operate with the keyswitch in the *Program* position ( ).
3. Pictorial instructions briefly describe the steps required for normal machine operation.
    1. Load the machine to the rated capacity.
    2. Securely close the loading door.

3. Select the appropriate formula for the goods in the machine.
4. Add chemicals if the machine is not connected to an automatic chemical delivery system.
5. Press the *Start button*.

4. The *Run Indicator light*, in the upper left corner of the *Start button*, indicates the type of wash step in progress. When the machine is operating in normal mode, e.g., running a wash formula, the on/off state of this light indicates the type of step in progress.
   - Steady on indicates a fill, a drain, or a bath step.
   - Brief flashes about every two to ten seconds indicate an extract step.
   - Steady off indicates a drain step.
5. The *Master switch* controls power to the control circuit of the machine. Changing this switch from the *on* position (⊖) to the *off* position (⊘) turns off the machine control circuit.
6. Press the *Emergency Stop button* to stop the machine by removing power from the machine controls. Formulas ended in this manner can be resumed at the beginning of the interrupted step by following the prompts on the display.
7. When selecting a specific formula to run, press the *Scroll Down button* (▼) to display the next lower numbered formula in memory. Press this button with the lowest formula displayed (Formula 01) to select the highest numbered available formula (maximum of 30 formulas).
8. The display on these machines is a vacuum fluorescent type displaying two lines of twenty characters each.
9. The *Scroll Up button* (▲) functions in much the same manner as the *Scroll Down button* described above. Press this button to display the next higher numbered formula in memory.
10. The *Next button* (☑) is not used during normal operation.
11. Press the *Signal Cancel button* (⦸) to silence the operator signal buzzer which sounds when a formula completes normally. Also, if a signal is programmed with a chemical injection in any formula, this button must be pressed to indicate that the chemical has been added and to resume operation.
12. The *Operator Signal light*, in the upper left corner of the *Signal Cancel button* (⦸), is a visual indicator that operator attention is required. This light is illuminated simultaneously with the sounding of the operator signal buzzer.
13. The *Manual button* (⊞) has no effect while a formula is running. Pressing this button when the display says “Run Formula xx” initiates manual mode, where the controls function as described in section 2.1.2 Control Functions During Manual Operation.
14. The *Terminate button* (✋) cancels all remaining steps in any running formula and initiates the shutdown procedure for the machine. Formulas ended in this manner cannot be resumed.

2.1.2. Control Functions During Manual Operation

Manual operation is used primarily for troubleshooting the machine by activating outputs and viewing inputs.

1. The *Start button* (1), when pressed while the *Manual button* is held down, activates the selected menu function. Depress the *Start* and *Manual buttons* simultaneously to view the software date code. For other manual menus, release the *Start button* when the menu appears on the display.
2. The *Run/Program keyswitch* has no effect on how the manual mode operates. However, the status of the switch (either + or –) is displayed in field F in the *Test Inputs* menu.
3. The pictorial instructions apply only to normal operation, not to troubleshooting or programming.

4. The *Run Indicator light* is not activated during manual operation.
5. The *Master switch* controls power to the control circuit of the machine. Changing this switch from the *on* position ( ) to the *off* position ( ) turns off the machine control circuit.
6. The *Emergency Stop button* removes power from the controller in the same manner as turning the *Master switch* off. If the *Run/Program keyswitch* is set to the *Run* position ( ) when power is restored, the controller will start in the normal operating mode with controls functioning as described in section 2.1.1 Control Functions During Normal Operation.
7. At the manual menu, the *Scroll Down button* ( ) displays the available menu items in reverse numeric order.
8. In the manual menu, the display presents user prompts and selected information. The software date code and machine configuration are displayed; inputs and outputs and their respective statuses are shown in those modes. Other menu selections display DIP switch settings, as well as temperature and level testing information.
9. The *Scroll Up button* ( ) displays the next higher numbered mode in the manual menu. For example, pressing this button once will scroll from the *Software Date Code* mode to the *Test Inputs* mode.
10. The *Next button* ( ) has no function in manual mode.
11. The *Signal Cancel button* ( ) has no function in manual mode.
12. The *Operator Signal light* does not operate when the controller is in manual mode.
13. Use the *Manual button* ( ) to enter manual mode when the machine is idle.
14. The *Terminate button* ( ) cancels manual mode and returns the controller to the normal operation or programming mode, depending on the setting of the *Run/Program* keyswitch. Any outputs that were manually actuated while in manual mode are turned off.

2.1.3. Control Functions During Programming

The programming mode is used to modify the actions performed in a wash formula, or to create new wash formulas.

1. The *Start button* ( ) is used in combination with the *Next button* ( ) or the *Terminate button* ( ) to delete or insert a step in a wash formula, respectively.
2. The *Run/Program keyswitch* allows programming when set to . The *Program menu* includes selections for adding and changing wash formulas, configuring the controller, and restoring the standard formulas provided with the machine. The keyswitch must be set to the *Run* position ( ) for normal machine operation, as described in section 2.1.1 Control Functions During Normal Operation.
3. The pictorial instructions apply only to normal operation, not to troubleshooting or programming.
4. The *Run Indicator light* is not actuated during programming.
5. The *Master switch* controls power to the control circuit of the machine. Changing this switch from the *on* position ( ) to the *off* position ( ) during programming will shut down the machine controls. Any programming changes made in the current session will be lost.
6. The *Emergency Stop button* removes power from the controller in the same manner as turning the *Master switch* off. If the *Run/Program keyswitch* is set to the *Run* position ( ) when power is restored, the controller will start in the normal operating mode with controls functioning as described in section 2.1.1 Control Functions During Normal Operation.
7. Use the *Scroll Down button* ( ) to change the selected programming parameter to the next lower-numbered choice.

8. The display presents the programming menus and choices within those menus, including all configuration and formula parameters.
9. The *Scroll Up button* (▲) scrolls the available choices upward from the lowest available number.
10. Use the *Next button* (☑) to confirm any choice and move to the next decision in the sequence.
11. The *Signal Cancel button* is not used in programming.
12. The *Operator Signal light* is not used in the programming mode.
13. The *Manual button* is not used in the programming mode.
14. The *Terminate button* (✋) returns the user to the main programming menu (top line of display reads *Program **X** Menu*) from the *Add/Change Formula* and the *Standard Formulas* menus. The *Terminate button* has no effect after the *Configure menu* has been accessed, or after any parameter of any formula has been accessed in the *Add/Change Formula menu*.

— End of BICJHC01 —

2.2. Selecting an Industry Formula Set

Document BICJHC02
Spec Date 20000831
As-of Date 20000831

This document applies to Milnor® HxJ, T5J, and 30015/30022VxJ model washer-extractors, all of which use the Milnor® "188 Processor EP+" processor board. This board can be positively identified by "P/N 08BH18EP_ " appearing near the Milnor® logo on the processor board.

The Milnor® factory configures each E-P Plus® washer-extractor controller for the industry specified by the purchaser when the machine is ordered. The configuration process consists of setting the DIP switches on the processor board and installing the appropriate industry nameplate on the machine faceplate. The DIP switch settings may be changed in the field, and new industry nameplates may be obtained from your dealer or the Milnor® parts department.

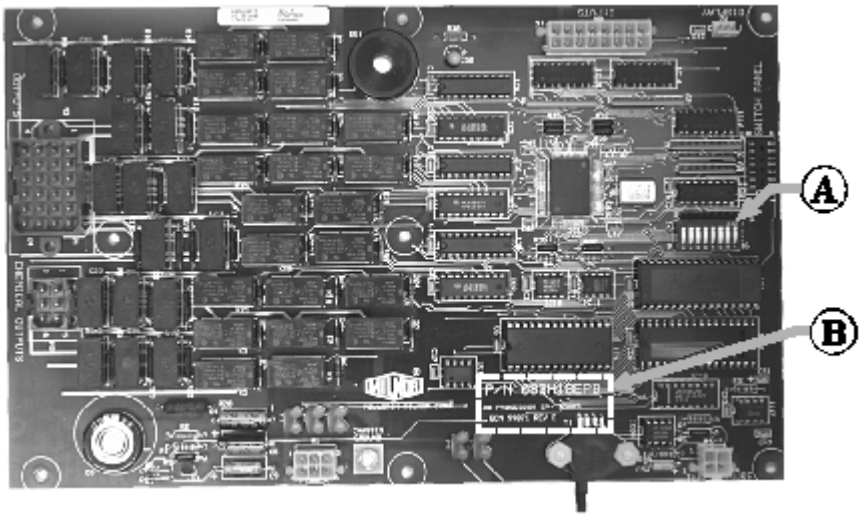
To change industry configuration, turn the machine *off* and gain access to the processor board.

DANGER 9: Electrocution hazard—Do not open the door to any electric box without first turning the power *off*. These controls use 120VAC power or higher, which is extremely dangerous.

The location of the DIP switches on the microprocessor board are shown in Figure 4, as are examples of the *on* and *off* positions. Set the switches to the desired configuration according to Table 4. Turn the machine *on*; the display will show the current configuration.

Figure 4: Location of DIP Switches

Processor Board



Legend

A. DIP switch
B. Board identification area
1. OFF
2. ON
3. ON
4. OFF

DIP Switch (Partial View)

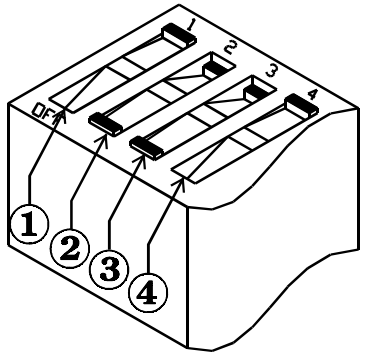


Table 4: DIP Switch Settings for Industry Configurations

Industry Configuration	Switch Settings							
	S1	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**
Correctional Facilities	ON	ON	ON	ON	This switch is not used in these models.	On prevents/Off allows skipping steps.*	These switches are not used in these models.	
Hotels and Motels	OFF	ON	ON	ON				
Athletic Laundries	ON	OFF	ON	ON				
Healthcare Facilities	OFF	OFF	ON	ON				
Restaurants	ON	ON	OFF	ON				
Commercial Laundries	OFF	ON	OFF	ON				
Shirt Laundries	ON	OFF	OFF	ON				
Offshore Laundries	OFF	OFF	OFF	ON				
Fire-Fighter	ON	ON	ON	OFF				
*** Setting S6 off enables the operator to cancel any step in progress except a drain before an extract.**								

— End of BICJHC02 —

2.3. Programming the E-P Plus® Controller

Document BICJHP01
Spec Date 20000831
As-of Date 20000831

The microprocessor controller used in this washer extractor operates in two modes, depending on whether the machine is being used to process goods (the *Run mode* or *Formula* menu) or is being programmed with operating characteristics to be used when a wash formula is started (the *Program* mode). This document describes the available operator actions and display feedback in the *Program* mode.

The *Program* mode is accessible only when the *Run/Program keyswitch* is set to the *Program* position ( ), as described below. From the *Program* menu, there are four options available:

- Option 0: OK TURN KEY TO RUN (detailed in section 2.3.2)
- Option 1: ADD/CHANGE FORMULA (detailed in section 2.3.3)
- Option 2: CONFIGURE (detailed in section 2.3.4)
- Option 3: STANDARD FORMULAS

Each of these options is described in detail in this document. For information on how to start the machine and run a formula, see the appropriate section listed in the table of contents of this manual.

2.3.1. How to Avoid Data Loss

CAUTION 10: Avoid Corrupting Formula Data—Never turn the *Run/Program keyswitch* from the *Program* position to the *Run* position unless the display says *OK Turn Key to Run*.

- Failure to follow this direction will result in the loss of all formula modifications entered during the current programming session. Formulas not modified during this session will not be affected.

CAUTION 11: Avoid Corrupting Configuration Data—Never shut off machine power, turn off the *Master switch*, or press the *Emergency Stop button* to exit the *Program* mode.

- Once the *Configure* menu has been accessed, all configure decisions must be confirmed by pressing the *Next button* ( ) before another action can be taken.
- Failure to follow this direction will result in corruption of machine memory.

Use the following procedures to clear corrupted formula and configuration memory and restore valid data.

Display or Action	Explanation
CHECKSUM ERROR TURN KEY TO PROGRAM	This display indicates that all memory will be cleared. **The machine controller must be reconfigured and any new formulas or modifications to standard formulas must be re-programmed.**
	Accesses the first configuration decision.
LANGUAGE ? 0=ENGLISH 0	First configure decision.

2.3.2. Return to Run Mode (Option 0)

Option 0 allows for a safe return from the *Program* mode to the *Formula* menu, preserving any changes that were made during the programming session and maintaining the integrity of programming and configuration data.

Display or Action	Explanation
PROGRAM 0 MENU OK TURN KEY TO RUN	This is *Option 0* of the *Program* menu. From this display, return to the *Formula* menu or select another available menu option.

Display or Action	Explanation
	Returns to *Run mode* (*Formula* menu)
or	
▲ / ▼	Scrolls the available choices in the *Program* menu.

2.3.3. Add or Change a Formula (Option 1)

Washer extractors with the Milnor® E-P Plus® control system have the capacity for up to 30 unique wash formulas. The space for these formulas is allocated in memory whether or not the formulas are actually used.

The user interface employs similar procedures for creating a new formula and for changing an existing formula. Both procedures are detailed below, in section 2.3.3.3 Create a New Formula and section 2.3.3.5 Change an Existing Formula. The control system will inform the person programming the machine whether the selected formula has already been programmed.

2.3.3.1. About the Programming Help Screens

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 0000----- -------	This is *Page A* of the programming menu. The cursor is at the first decision (*T*=Type of Step). Each decision has an associated help screen.
03 T TYPE OF STEP 01 0 END FORMULA	This is a typical programming help screen. Help screens appear automatically if no valid entry is made within four seconds of accessing the decision.
	Accepts the selected value for the current decision and advances the cursor to the next decision, regardless of the status of the help screen.
1	At either *Page A* or *B*, displays formula and step name for selected step if the help screen has not appeared.
MODIFYING FORMULA 03 - STEP 01	This is a typical display of the formula and step name.

2.3.3.2. Moving Forward and Backward through Steps and Decisions—Each step has two displays: *Page A* and *Page B*.

Display or Action	Explanation
03 TMMQFFFHC **SCWSS*** **01**	This is *Page A*. In this example, the "03" at the left end of the display represents the formula number. The "01" below it represents the step number within that formula. The *CWSS** decisions shown in bold repeat for each chemical programmed in this step.
03 **SPD** D E 01	This is *Page B*. When the cursor is advanced past the last decision on *Page A*, *Page B* appears for the remaining decisions in this step. The decisions required on both pages vary according to machine model and options.

2.3.3.2.1. Actions when the Cursor is at the Step Number

Display or Action	Explanation
▲ / ▼	Indexes forward/backward through the step numbers in this formula.
☑	Accesses the selected step and positions the cursor at decision *T*, or saves all changes and exits this formula if this is the last step of an existing formula.
☜	Exits this formula, clearing the formula if it has not been saved, or discarding any changes to a previously existing formula.

2.3.3.2.2. Actions when the Cursor is at a Decision within a Step

Display or Action	Explanation
☑	Moves the cursor forward among *Pages A* and *B* through each valid decision in a specific step. This accepts the standard or default decision if another choice was not previously made.
☜	Moves the cursor backward among the two pages, through each valid decision within a specific step, except in the following cases: • If the cursor is at decision *T* on *Page A*, it will move to the step number. • If the cursor is at the first decision on *Page B*, it will back up to the first decision (*C*) for the first chemical commanded in this bath.
1	Displays the name of the formula and step being modified.

2.3.3.3. Create a New Formula—Creating a new formula with the E-P Plus® controller entails adding and defining steps in one of the existing but blank formulas.

Display or Action	Explanation
PROGRAM 1 MENU ADD/CHANGE FORMULA	This is *Option 1* of the *Program* menu. From this display, either access a formula by number to change or create, or select another available menu option.
☑	Accesses the formula list for selection of a formula number to change or create.
ADD/CHANGE FORMULA 00 RETURN TO MENU	This is the *Add/Change Formula* display. From this display, either back up to the *Program* menu, or begin creating or changing a formula.
▲ / ▼	Scrolls the available formula numbers. If the selected formula number hasn't already been programmed, it is selected for *add*. If the number has already been programmed, it is selected for *change*, as shown in the following two displays.
ADD/CHANGE FORMULA 23 FORMULA NUMBER 23	Formula 23 is available for adding because it does not currently exist.

Display or Action	Explanation
ADD/CHANGE FORMULA 07 FORMULA NUMBER 07	Formula 07 is available for changing because it already exists.
☑	Accesses the selected formula for programming. Valid formula numbers are 01 through 30.
07 TMMQFFFHC LSCWSS* 01 205012523 200----	Formula 07, Step 01 selected for programming.

2.3.3.4. Delete an Existing Formula

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 0000------ ------	Delete an existing formula by making step 01 an *End* step. Accomplish this by setting the *T* value for step 01 of the formula to 0.

2.3.3.5. Change an Existing Formula

2.3.3.5.1. How to Insert or Delete a Step in an Existing Formula

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 112217513 2121250	Cursor blinking on step number indicates that adding or deleting a step is allowed.
1	Provides a help screen for inserting and deleting steps, as shown below.
START+NEXT/TERM TO INS/DELETE THIS STEP	This is the help screen for inserting and deleting steps.
☑	Advances the cursor without deleting or duplicating the selected step. This key accesses the next step and allows for modification of the values there.
▼	Scrolls through the available choices for the decision indicated by the cursor.

Inserting a Step

Display or Action	Explanation
1 + ☑	Duplicates the selected step to the next numerical position. If this is Step 01, the duplicated step becomes the new Step 01 and all the following steps move to the next higher numerical position. Duplication of *End Formula* or *Extract* steps is prevented by the controller.
03 TMMQFFFHC LSCWSS* 01 NEW STEP01 DUPED	This display indicates that the new step has been created as a copy of the previous step.

Deleting a Step

Display or Action	Explanation
1 + 9	Deletes the selected step. The next step becomes the current step by assuming the number of the step that was just deleted. All following steps move one number lower. Deletion of *End Formula* is prevented in all cases. A *Bath* step can not be deleted if it falls between two *Extract* steps.
03 TMMQFFFHC LSCWSS* 01 STEP DELETED	This display indicates that the selected step has been deleted from the wash formula.

2.3.3.5.2. The Step Decisions—A maximum of 30 formulas may be programmed, with a maximum combined total of 225 steps in all formulas.

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01	This is the *Type of Step* decision display.

Display or Action	Explanation
0	End formula: The last step of each formula must be of type 0. This step is automatically added as a last step if the previous step is type 6 (final extract). A formula may be ended without a final extract by setting the last step to type 0. If the last step before the End Formula step is a type other than final extract, the controller will ask “End Formula #xx?”. Setting the first step of an existing formula to type 0 deletes the formula, as described in section 2.3.3.4 Delete an Existing Formula.
1	One-way wash: Washing routine for increased mechanical action and minimum energy consumption. Use for smaller pieces where tangling and “roping” is not a consideration.
2	Two-way wash: Washing routine for use with bedsheets and other large items which tend to rope and tangle unless reversed.
3	Soak wash: The cylinder does not turn when this step type is programmed. Use this step type only when no mechanical action is required, as for especially delicate fabrics. Consider chemical concentrations, bath time, and liquor temperature when using this type of step.
4	Intermediate extract 1 (E1): This is the lowest extract speed for HxJ, FxJ, and 36-inch and 42-inch VxJ models. For other models, this is low extract speed, used for extractions between baths or for final extract at low speed if machine has two-speed extract.
5	This selection differs with machine model. For FxJ, HxJ, and 36-inch and 42-inch VxJ models, this causes an intermediate extract (E2). For other models, this is the final extract sequence. In final extract the machine runs at intermediate extract speed for a duration determined by machine model and configuration, the runs at high extract speed for the remainder of the programmed extract time. The formula ends when the commanded extract time expires.
6	Final extract (E3): For certain models only, this is the sequence leading to the highest extract speed. The machine executes an intermediate extract 1 (*E1*) for a duration of 100 seconds. After 100 seconds at *E1*, the machine accelerates to *E3* (high extract speed) for the remainder of the programmed extract time. When the programmed extract time ends, the cylinder stops and the formula ends.

Display or Action **Explanation**

CAUTION 12: Avoid damage to extract motor—For machines with software date code 95005 or earlier, the minimum valid time for a final extract step is 1:45 (MMQ=013). Attempts to program final extract steps shorter than 1:45 may cause the controller to continue indefinitely in high extract. Machines running software dated 95006 or later will terminate at the programmed time, but short extract times may not allow the machine to achieve high extract speed.

- Never program a final extract step for less than 1:45 (MMQ=013) unless the machine has software dated 95006 or later.
- If the step timer stops counting down at about 1:20 in a final extract, press ✋ to terminate the program, then edit the formula to increase the duration of the final extract beyond 1:45.

```
03 TMMQFFFHC LSCWSS*
01 1
```

Duration of step in minutes, minutes, and quarter minutes.

000 Invalid entry. Controller defaults this entry to 001 (15 seconds).

001 00.25 minutes; 00:15 seconds is minumum programmable time for a bath step.

013 01.75 minutes; 01:45 seconds is the minimum valid time for an extract step. Programming an extract step shorter than this may cause the timer to stop counting down.

113 11.75 minutes; 11:45

633 63.75 minutes; 63:45 is the maximum programmable time for any single step. To achieve a bath time longer than 63:45, program two consecutive bath steps with the first ending with a *No Drain*. This effectively doubles the maximum allowable bath time.

The total time required for a formula to run to completion includes factors other than the total of the times of each step in the formula. For these machines, add 0:40 distribution time each time the machine enters an extract step from a bath step. Also, add 1:00 for each standard drain (drain speed), or 1:00 for each two-way wash drain.

```
03 TMMQFFFHC LSCWSS*
01     xxx
```

Temperature decision appears only if the machine is supplied with and configured for temperature control (Temp Control = Yes), as described in section 2.3.4 .

FFF or CCC Degrees Fahrenheit or Celsius in this bath. Units are selected in the *Configuration menu*.

--- Display if no temperature is commanded

050°F/010°C Minimum temperature in any bath

205°F/095°C Maximum temperature in any bath

```
03 TMMQFFFHC LSCWSS*
01         x
```

Control of hot water valve

Display or Action	Explanation
	0 Hot water valve off
	1 Hot water valve on
	2 Raises temperature of filling water. See section 2.3.3.5.3 for more information.
	3 invalid response—not allowed
03 TMMQFFFHC LSCWSS* 01 x	Control of cold water valve
	0 Cold water valve off
	1 Cold water valve on
	2 invalid response—not allowed
	3 Lowers temperature of filling water. See section 2.3.3.5.4 for more information.

If a temperature is programmed in a step, the control requires either modulated water (H=2 and C=1 or 3, or C=3 and H=1 or 2) or steam injection, otherwise the cursor returns to the temperature decision for correction. See section 2.3.3.5.3 for details on how to regulate the temperature of incoming water.

2.3.3.5.3. How to Modulate Water Valves to Regulate Incoming Water Temperature—When programming a thermo-modulated temperature for a bath using both hot and cold water valves, the relationship between the desired temperature and the temperature of a split fill (hot and cold valves open simultaneously) is important.

If the desired temperature is hotter than the normal split temperature, a faster, more accurate fill with a more constant temperature is achieved by programming the hot water valve open (H=1) and the cold water valve to open only to lower the fill temperature (C=3).

If the desired temperature is colder than the normal split temperature, similar results can be achieved by programming the hot water valve to open only to raise the fill temperature (H=2) and the cold water valve to remain open constantly (C=1).

2.3.3.5.4. How to Use Cooldown—A cooldown is programmed as a separate bath step following the bath in which the cooldown is desired. In the cooldown step, command a desired cooldown temperature with all water valves programmed off (0). The E-P Plus® control automatically inserts a *no drain* in the previous bath and 010 in MMQ, for a step time of 1:00.

The commanded cooldown temperature must always be at least 15 degrees Fahrenheit (8 degrees Celsius) hotter than the hottest ambient temperature or the hottest cold water temperature that will be encountered. If this rule is not followed, achieving the desired cooler temperature may take a long time, or even be impossible.

After the desired cooldown temperature has been achieved for 15 seconds, the cooldown process will continue for one minute. Upon completion of the cooldown process, the machine will drain unless a *no drain* was programmed to prolong the cooldown bath. Prolonging of the cooldown bath is useful especially in cases where chemicals are to be added to the cooler bath liquor.

Display or Action	Explanation
ILLEGAL COOLDOWN STEP. PRESS START	This display results from commanding all water valves off (0) in a bath **following an extract step**.

Display or Action	Explanation
1	If the machine is configured for cooldown, this keystroke returns the cursor to the time field (MMQ). If the machine is not configured for cooldown, but is configured for temperature control, this keystroke returns the cursor to the temperature field (FFF). If temperature control is not configured, this keystroke returns the cursor to the first water valve field.

2.3.3.5.5. How to Select the Bath Level

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 x	The values of high and low bath levels are determined by machine configuration, as described in section 2.3.4.2 .
1	Low bath level
2	High bath level

2.3.3.5.6. How to Select the Steam Code

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 x	Appears only if the machine is supplied with and configured for temperature control (*Temp control*=yes) and steam (*Steam error* greater than 0).
0	no steam in this bath

The six available steam codes are combinations of three *yes/no* decisions, as described below.

- *Early* refers to whether steaming should begin at the lowest safe level, or if steaming should only begin after the commanded level is achieved. Usually, a “Start Steaming Early” code (4, 5, or 6) is used when the machine receives only cold water or when the hot water in the plant has a relatively low temperature. Use a *No* response if the machine has both hot and cold water valves and the commanded temperature is lower than the hot water temperature.
- *After* refers to whether steam is allowed in this bath after temperature has been achieved once and subsequently fallen below the commanded temperature. A *No* response prevents a second steaming after temperature is first achieved. Use *No* if chemicals or goods may be damaged by steam after a chemical injection (as in bleach baths).
- *Timer* refers to whether the timer runs or stops while steaming up to temperature. *Stops* causes the timer to stop counting until the commanded temperature is first achieved. *Runs* is for use when some temperature fluctuations are acceptable or when it is certain that the commanded temperature will be nearly achieved while filling. Use *Stops* if temperature must be achieved before adding chemicals, otherwise software will suppress this chemical-add choice.

Display or Action	Explanation
	1 Early=No; After=Yes; Timer=Runs. Control does not start steaming until commanded liquor level is achieved; if necessary, steam is allowed after temperature is first achieved; timer runs while steaming up to temperature.
	2 Early=No; After=No; Timer=Stops. Control does not start steaming until commanded liquor level is achieved; steam is not allowed after temperature is first achieved; timer stops while steaming up to temperature.
	3 Early=No; After=Yes; Timer=Stops. Control does not start steaming until commanded liquor level is achieved; if necessary, steam is allowed after temperature is first achieved; timer stops while steaming up to temperature.
	4 Early=Yes; After=Yes; Timer=Runs. Control starts steaming at lowest safe level; if necessary, steam is allowed after temperature is first achieved; timer runs while steaming up to temperature.
	5 Early=Yes; After=No; Timer=Stops. Control starts steaming at lowest safe level; steam is not allowed after temperature is first achieved; timer stops while steaming up to temperature.
	6 Early=Yes; After=Yes; Timer=Stops. Control starts steaming at lowest safe level; if necessary, steam is allowed after temperature is first achieved; timer stops while steaming up to temperature.

2.3.3.5.7. Injecting Chemicals

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 x	Chemicals can be added to any bath other than a cooldown bath. A standard chemical injection can be prevented by commanding C = 0 (no chemical in this bath) or by commanding SS = 00 (zero seconds of chemical inject time). No more than two chemicals can be programmed per bath.
	0 No chemical in this bath
	2 Inject chemical number 2
	5 Inject chemical number 5 (Five is maximum number of chemicals.)
03 TMMQFFFHC LSCWSS* 01 1	Select the option determining the point in the step at which this chemical will be injected.

Display or Action	Explanation
	0 with fill. The chemical will be injected simultaneously with the opening of the water valves.
	1 at level satisfied. The chemical injection begins only after the commanded bath level has been achieved.
	2 at level and temperature satisfied. This option is only available if a steam code of 2, 3, 5, or 6 is used (see section 2.3.3.5.6) to achieve a specified temperature with *Timer Stops* commanded (also described in section 2.3.3.5.6).
03 TMMQFFFHC LSCWSS* 01 xx	Program the duration of the chemical injection, in seconds.
	00 Zero seconds, prohibits this chemical injection.
	40 40 seconds. If no specific time is entered, the control automatically inserts a value of 40. Any other value between 00 and 255 (entered as "Q5") may be specified and will override the 40-second default duration
	B9 119 seconds (example)
	Q5 255 seconds (maximum duration)

Inject times longer than 99 seconds are programmed in the two-digit inject time field by using alphabetic characters to represent values greater than 99 in the first position. The letters A through Q are used, but not the letter O. The second position is always a number between 0 and 9. Values of the alphabetic characters are defined in Table 5 below:

Table 5: Codes for Inject Times of 100 Seconds and Longer

Alphabetic Code	Value	Alphabetic Code	Value	Alphabetic Code	Value	Alphabetic Code	Value
A	100	E	140	I	180	M	220
B	110	F	150	J	190	N	230
C	120	G	160	K	200	P	240
D	130	H	170	L	210	Q	250

CAUTION 13: Risk of Poor or Inconsistent Wash Quality—Chemical injections should always have a duration of at least 10 seconds. With shorter injection times, fine adjustments are not possible, and variations in response times have an exaggerated effect on the quantity delivered.

- Select pumps or valves of the appropriate size to provide for longer injection times.
- If quantities of one chemical must vary greatly among formulas, use two pumps or valves for that chemical.

Display or Action	Explanation
03 TMMQFFFHC LSCWSS* 01 0	Is a signal required when the chemical is desired? The signal will not occur until the *When to start chemical injection* decision is satisfied. The commanded chemical injection will not begin until the signal is cancelled.

Display or Action	Explanation
	0 No. A signal is not required with this chemical injection. Chemicals will inject without operator intervention.
	1 Yes. A signal is required with this chemical injection. The signal will start when all programmed conditions for the chemical (temperature and/or level) are satisfied. The actual injection will begin only after the signal is cancelled, as below.
	During normal operation (formula running), this keystroke cancels the operator signal and allows chemical injection to begin if this decision is set to *1=Yes*.
03 TMMQFFFHC LSCWSS* 01 3	After programming the first chemical, the controller returns to the first chemical decision to allow the programming of a second (final) chemical.
	0 No additional chemical in this bath. The cursor advances to the next decision.
	3 Chemical 3 (or any other valid chemical number). Cursor advances to decision *W* for this chemical.
03 SPD D E 01 x	Select the wash speed for this step. The default value is *Wash 1* for factory-supplied formulas and new bath steps.
	0 Wash speed 2: High wash speed for use with goods requiring less mechanical action. The mechanical action is reduced because the higher speed reduces the distance the goods are dropped.
	1 Wash speed 1: Normal wash speed.

CAUTION 14: Machine Malfunction and Damage Hazard—The variable speed inverter used in all single-motor models was programmed at the Milnor® factory for optimum performance with your machine. The constants necessary to maintain this performance are written inside the electrical box housing the inverter. Do not enter any values other than those listed for inverter constants.

03 SPD D E 01 x	Select a drain type for this bath step.

Display or Action	Explanation
	0 Standard drain speed—basket turns clockwise at drain (distribution) speed.
	1 Two-way wash speed—basket reverses at wash speed to provide more mechanical action on the goods as the bath liquor is draining away.
	2 Do not drain—bath liquor is retained for later operations in this same bath. Chemicals may be added, and temperature or level may be raised without draining.
	3 Stop with fill—the basket is kept stationary during the fill previous to this drain, but rotates at drain speed for this drain.
	4 Stop with drain—the basket is kept stationary during the drain, allowing no mechanical action.
	5 Stop with fill and drain—a combination of drain types 3 and 4, the basket is held stationary during the previous fill and the current drain.
`03 TMMQFFFHC LSCWSS*` `02 x`	The cursor returns to this display to program the next step unless the step just programmed is the last step of a formula or if the number of steps exceeds 50, in which case the cursor advances to decision *E*.
`END FORMULA #03` `0 NO`	Appears if *T=0* in previous display and this is not the last available step in this formula.
	0 No. Aborts the previous *T=0* selection. Display returns to the *T* (type of step) decision.
	1 Yes. Accepts that the formula ends here.
`03 SPD D E` `02 x`	Determine how this formula is to end.
	0 Stopped. Operator must press ⦸ to silence the signal.
	1 Reversing at wash speed. Operator must press ⦸ to end the formula.
	2 Drain speed. Operator must press ⦸ to end the formula.
	3 Tumble at wash speed. Signal sounds after two minutes. Operator must press ⦸ to end the formula.
`ADD/CHANGE FORMULA` `00 RETURN TO MENU`	Appears if step just previously programmed is the last step of the formula. The controller is prepared for adding or editing another formula, or returning to the *Programming menu*.
☑	Returns to the *Program menu*.
`PROGRAM 0 MENU` `0K TURN KEY TO RUN`	This is the *Program menu*.
☑	Saves changes and new formulas, then returns to the *Run mode*.
`RUN FORMULA` `00 OK TO POWER OFF`	This is the *Run Formula* display.

2.3.3.5.8. How to Save or Discard Changes—Use the procedures detailed above to navigate in a formula and make changes. The following procedures should be used to return to the formula menu and either save or discard the changes made.

Display or Action	Explanation
	Saves all changes if the cursor is on the *Step Number*. This key may need to be pressed more than one time to exit the formula.
	Exits the formula and discards all changes made during this programming session.

2.3.4. Configure the Control (Option 2)

Because the microprocessor control system used in this machine is capable of controlling several different models with a wide variety of options, each unit must be configured to match its specific model and type of washer-extractor. This configuration informs the microprocessor of the characteristics of this machine, such as the number of water valves, the presence of temperature control, cooldown, etc. Such decisions are discrete to the specific machine and must never be changed unless options are later added or removed. In addition to these hardware-specific decisions, certain configuration choices, such as the display of English or metric units, are left to the discretion of the owner/operator.

CAUTION 15: Configure Data may be Lost—If the controller loses power either accidentally or intentionally while in the *Configure mode*, all configuration data may be corrupted. Reconfigure the controller at installation and any time a memory error is detected. Although certain codes are discretionary and are so marked below, most configure codes must match those shown on the metal configuration nameplate unless optional equipment has been added to or removed from the machine.

2.3.4.1. Moving Forward and Backward in *Configure*

Display or Action	Explanation
PROGRAM 2 MENU CONFIGURE	This display indicates that the controller is in *Program mode* with the *Configure menu* selected for access.
	Access the *Configure menu* and displays the first configuration decision.
LANGUAGE ? 0=ENGLISH 0	The language option that appears here may vary according to how the controller was last configured.
	Accepts the displayed selection and automatically advances to the next configure decision.
	Accepts the displayed selection and reverts to the previous configure decision. In certain cases earlier decisions will affect later ones. For example, configuring for no temperature control will automatically configure the controller for *no steam*, even if temperature control is later configured.

2.3.4.2. The Configure Decisions

Display or Action	Explanation
LANGUAGE ? 0=ENGLISH 0	Display of *Language* configuration decision. The language chosen here controls all programming and operational prompts on the machine display.
▲ / ▼	Scrolls the available languages, listed below. 0 = English 1 = Spanish 2 = French 3 = German 4 = Dutch 5 = Italian 6 = Portuguese
☑	Accepts the selected value for the current decision and advances the cursor to the next decision, regardless of the status of the help screen. This action is required for each configuration decision.
TEMP CONTROL ? 0=NO, 1=YES 1	Select *0=No* if this machine is not equipped with steam, cooldown, or the equipment required to provide or control these optional functions. If *0=No* is selected, the next available decision will be *Water Level Units*. Select *1=Yes* if this machine is equipped with the necessary valves and supply piping to perform steaming and/or cooldown, as well as any necessary electronic boards to control these options.
TEMP UNITS ? 0=°F, 1=°C 0	Select *0=°F* to use Fahrenheit as the temperature scale. Select *1=°C* to use Celsius as the temperature scale. **Note 2:** This decision appears only if the machine is configured for temperature control (the value for the *Temp Control* decision, above, must be 1).

Display or Action	Explanation
STEAM ERROR ? 0 = NO STEAM 0	This decision appears only if the machine is configured for temperature control (described above). Select *0=No Steam* if the machine is not equipped for steaming, as in the case of a machine with temperature control used exclusively for cooldown. Select from options 1 through 3 if steam is available. The number of minutes selected is the maximum time that the machine will steam in an attempt to achieve the desired temperature before a steam error is displayed. This self-clearing error does not stop machine operation. However, for formula steps where the timer is commanded to stop while steaming until the desired temperature is achieved, production may be severly restricted by steam errors.
COOLDOWN ERROR ? 0 = NO COOLDOWN 0	This decision appears only if the machine is configured, and equipped with the mechanical and electrical hardware for temperature control (described above). Select *0=No Cooldown* if the machine is not equipped for cooldown, as in the case of a machine with temperature control used exclusively for steaming. Select from options 1 through 3 if cooldown is available. The number of minutes selected is the maximum time that the machine will cooldown in an attempt to achieve the desired temperature before an error is displayed. The error is self-clearing and does not stop machine operation. However, production may be severly restricted by cooldown errors if the cooldown temperature is set lower than the incoming cold water temperature.
WATER LEVEL UNITS? 0=CM 1=INCHES 1	Select *0=CM* to have the water level displayed in centimeters. Select *1=INCHES* to display water level in inches.
OFFSET HEIGHT ? 18	This value is set at the Milnor® factory to compensate for the height difference between bottom of the cylinder and the location of the pressure tube connection on the drain sump. Because the pressure tube between the pressure transducer and the cylinder connects at an elevation not exactly equal to the bottom of the cylinder, this value allows for an accurate display of the water level. The unit of this value is tenths of an inch, so a difference of 1.8 inches is entered as 18. The maximum allowable value is 3 inches prior to software version 97004, and 4.5 inches with software versions 97004 and later.
LOW LEVEL HEIGHT ? 6	This value is the depth of the water measured from the bottom of the cylinder shell. This level will be used for any programmed bath step commanding a low level of bath liquor. The minimum valid value for this decision is 5 inches (13 centimeters), and the maximum value is 10 inches (26 centimeters).

Display or Action	Explanation
HIGH LEVEL HEIGHT ? 10	This value is the depth of the water measured from the bottom of the cylinder shell. This level will be used for any programmed bath step commanding a high level of bath liquor. The minimum valid value for this decision is equal to the value of the *Low Level Height* configured just before. The maximum value is 10 inches (26 centimeters).
MACHINE TYPE ? 0=VxJ, 1=TxJ 0	This decision only appears on T5J, V6J, and V7J models with basket dimensions of 30015 and 30022. Select the appropriate machine type as stated on the machine nameplate.

CAUTION 16: Avoid machine malfunction—Improper configuration will cause machines to malfunction.

- Misconfigured VxJ models will only run at one wash speed and one extract speed.
- Misconfigured TxJ models will run in only one wash speed, and will not run in high extract speed.

2.3.5. Restoring Standard E-P Plus Formulas [Document BICJUP01]

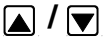
Programming mode 3 allows the owner/operator with access to a programming key to perform either of these two actions:

1. *Option 0* replaces all existing formulas with the factory default formulas for the selected industry configuration. This selection replaces formulas 1 through 10 with the standard industry formulas and removes all data from formulas 11 through 30.
2. *Option 1* replaces only formulas 1 through 10 with the standard industry formulas. This leaves any user-programmed data in formulas 11 through 30 intact.

CAUTION 17: Avoid Data Loss—Other than the two methods described above, it is not possible to selectively delete field-modified or field-programmed formulas with this programming mode. This mode erases all field-programmed formulas 1 through 10 or 1 through 30 as specified. For selective deletions and modifications, use *Program mode 1* (Add/Change Formula).

The remainder of this document details the procedure for restoring the industry standard formulas on models employing the Milnor® E-P Plus® controller.

Display or Action	Explanation
PROGRAM 0 MENU OK TURN KEY TO RUN	This is *Option 0* of the *Program menu*. From this display, either return to *Run mode* or select another menu item.
▲ / ▼	Scrolls available choices (0 through 3) in the *Program menu*.
PROGRAM 3 MENU STANDARD FORMULAS	This is *Option 3* of the *Program menu*.

Display or Action	Explanation
	Accesses the *Standard Formulas* option of the *Program menu*.
CORRECTIONAL LAUNDRY 0 DEFAULT 30 FORMULA	*Option 0* (Default 30 Formulas) of the *Standard Formula menu* effectively deletes all 30 formulas, then replaces formulas 1 through 10 with the factory-supplied standard formulas for the selected industry. Formulas 11 through 30 are replaced with blank formulas.
CORRECTIONAL LAUNDRY 1 DEFAULT 10 FORMULA	*Option 1* (Default 10 Formulas) deletes only formulas 1 through 10 and replaces them with the factory-supplied standard formulas for the selected industry. Formulas 11 through 30 are not modifed with this selection.
	Scrolls the available choices (*0 Default 30 Formulas* or *1 Default 10 Formulas*).
	Cancels this procedure without changing or deleting any formulas.
PROGRAM 3 MENU STANDARD FORMULAS	If the procedure is cancelled, the display returns to *Option 3* of the *Program menu*.
	Defaults the selected set of formulas, either 1 through 30, or 1 through 10.
CORRECTIONAL LAUNDRY ** PLEASE WAIT **	Appears for approximately five seconds as the standard formulas are written.
PROGRAM 3 MENU STANDARD FORMULAS	Replaces the previous display when the process is completed.
	Scroll to *Program menu* item *0* before exiting *Program mode*.
PROGRAM 0 MENU OK TURN KEY TO RUN	This is *Program menu* item *0*. It's now safe to turn the *Run/Program keyswitch* to the *Run* position.
	Returns to *Formula menu*.
RUN FORMULA 00 OK TO POWER OFF	*Formula menu*; run a formula or shut down the machine.

— End of BICJHP01 —

Chapter 3
Operating

3.1. Running a Formula

Document BICJHO01
Spec Date 20000831
As-of Date 20000831

3.1.1. Applying Power

Display or Action	Explanation
	The *Run/Program keyswitch* must be set to the *Run* position before the main wall disconnect (fuse or circuit breaker) is closed to provide power to the machine.

When power is first applied to the machine, the display shows the software copyright information, machine name, and the checksum number. The checksum number changes with any programming change. To detect unauthorized programming, record the checksum at the end of each authorized programming session and compare it to the checksum displayed at each power up.

Some Milnor® washer extractors with E-P Plus® controls do not use a speed sensing device to verify that the basket has stopped rotating. Therefore, when power is first applied to the machine, at least 80 seconds must elapse before any further operations can be attempted. This provides sufficient time for the basket to coast to a complete stop if power was lost while the machine was in a high speed extract and restored before the basket stopped.

DANGER 18: Entanglement Hazard—The linen inside or hanging partially outside a turning cylinder can suddenly wrap around your hand, arm, or body. The inertia of the spinning cylinder can cause the entangled linen to twist off or sever body parts. You can be killed or seriously injured.

- Never put any part of your body inside this machine or touch the linen while the machine is turning.

3.1.2. Selecting and Starting the Formula

3.1.2.1. Load Machine and Close Door—Load the machine to the rated capacity and securely close the loading door. Review Determining Load Size (see table of contents) for guidelines on loading machines.

3.1.2.2. Selecting a Formula

Display or Action	Explanation
RUN FORMULA 00 OK TO POWER OFF	This is the *Run Formula display*. From this display, the operator can disconnect power from the machine without risking damage to electronic parts, or he can select a formula to run, as described below.
▲	indexes **forward** through the 30 formulas.
▼	indexes **backward** through the 30 formulas.
RUN FORMULA 07 FORMULA NUMBER 07	Example display: Formula 07 selected for running.
1	starts the machine with the selected formula.
RUN FORMULA DOES NOT EXIST	indicates that the formula selected for running has not been programmed or is not available. This display appears for three seconds.

3.1.3. Unloading the Machine

How a formula ends depends on the machine type, how the last step of the formula was programmed, and whether the formula finishes without interruption or is terminated manually.

DANGER 19: Entanglement Hazard—The linen inside or hanging partially outside a turning cylinder can suddenly wrap around your hand, arm, or body. The inertia of the spinning cylinder can cause the entangled linen to twist off or sever body parts. You can be killed or seriously injured.

- Never put any part of your body inside this machine or touch the linen while the machine is turning.

Note 3: Depending on the *How to End code*, the controller will describe how the cycle is ending and instruct the operator to press ✋ to escape this step in the cycle.

Display or Action	Explanation
UNLOCKING THE DOOR PLEASE WAIT	display during the last 15 seconds of coast, or during the entire coast time if the formula was manually terminated.
WAITING TO UNLOAD U	At the end of the coast time, the operator alarm sounds.
⊘	Silences the operator alarm. The door unlocks, and the machine may be unloaded.

3.1.4. The Display during Automatic Operation

Display or Action	Explanation
23:04 F02S01 02:37 TEMP A168/D170 LEV 1 23:04 STEP 01 02:37 TEMP A168/D170 SPD 0	These two displays alternate during normal operation.
23:04 F02S01 02:37	23:04 is the time remaining in the formula. F02S01 indicates that the current formula is 02 (F02) and the current step is 01 (S01). 02:37 is the time remaining in this step.
23:04 STEP01 02:37	STEP01 is the current step EXTRACT indicates that the machine is currently executing an extract. TIMEHALT indicates that the timer is stopped while a chemical is being injected. The chemical supplier must connect equipment for this option.
TEMP A168/D170 LEV 2	Temperature in this machine is measured in degrees Fahrenheit or Celsius, according to machine configuration. A168 indicates that the current achieved temperature is 168 degrees. Temperature is displayed only if machine is equipped with and configured for temperature control. D170 indicates that the desired temperature for this step is 170 degrees. Temperature is displayed only if the machine is equipped with and configured for temperature control. LEV 2 indicates that the bath level achieved is Level 2.
SPD 0 LEV 2	SPD 0 indicates the bath speed (either 0 or 1) for this step. WAIT FOR LEVEL 2 H indicates that Level 2 is programmed for this step, but is not yet achieved. The H indicates that the hot water valve is open; C indicates cold water, and 3 indicates extra water. CHEM 03 is displayed when Chemical 03 is being injected. The number for each chemical (up to five may be connected) is displayed as the chemical is injected. See also section 3.1.7 for information about the chemical flush valve. FINAL EXTRACT indicates that the step in progress is the final step of the wash formula.

3.1.5. How to Shorten, Terminate, or Suspend a Running Formula

Display or Action	Explanation
☑ + 1	Cancels a step. Advances the step timer to zero for any bath, a drain not followed by an extract, or any extract in progress. The next step begins automatically. This operation is possible only if DIP switch 6 on the processor board is in the *off* position, allowing the cancelling of steps.
↯	Cancels the current formula and returns the machine to the *Run Formula* display.
RUN FORMULA 00 OK TO POWER OFF	This is the *Run Formula* display. The door interlock, described in section 3.1.3 , must expire before the door can be opened.

3.1.6. How to Restart after Power Loss

The E-P Plus® control remembers the formula and step it was executing if power fails or if the wall disconnect or master switch is turned off while the machine is operating in automatic mode.

Display or Action	Explanation
PRESS START TO RUN STEP xx - FORMULA yy	On most machine models, this display appears when power is restored. The formula and step which were in progress when power was interrupted are shown.
1	Resumes the formula at the displayed formula and step. If the outage occured in a bath step, level and temperature (if commanded) must again be satisfied, even if these were already satisfied before power was lost. Any commanded chemicals will be injected again. If the outage occured during a drain, that step will be repeated, then followed by the next commanded step. If the outage occured during an extract step, the previous bath will be repeated before the extract step begins.
↯	Terminates the formula in progress.

3.1.7. How the Flush Valve Works

The E-P Plus® controller includes an output signal that activates the flush valve for 30 seconds after the last chemical has been injected into each bath. If a bath is shortened or terminated before of while this valve is energized, the flush valve will be turned off. Shortening or terminating a bath may prevent the flush valve from activating.

3.1.8. How Cooldown Works

Goods must be cool enough to handle immediately after a wash cycle is finished. However, a drastic temperature change may set wrinkles in goods of certain fabrics. Therefore, many Milnor® washer extractors employ a feature called cooldown to gradually lower the water temperature and thus provide cool goods at the end of the wash cycle without setting wrinkles.

For HxJ models, the cooldown valve is turned on until high (cooldown) level is reached. This causes the drain to open and the cooldown valve to close until high level is lost. When high

level is lost, the drain closes and the cooldown valve opens. This process continues until the cooldown step is complete.

— End of BICJHO01 —

3.2. Viewing and Clearing the Formula Count Accumulator

Document BICJUD01
Spec Date 20000831
As-of Date 20000831

The microprocessor controller increments a discrete counter for each formula near the end of the formula. This count is maintained until the counter is cleared. The maximum number of times a formula can be counted before resetting the accumulator is 999, after which the count will remain at 999 until cleared. The count for each formula can only be viewed and/or cleared while the machine is in the *Run* mode but not running a formula (machine is idle).

CAUTION 20: Avoid Corrupted Accumulator Data—The accumulated data can be corrupted or become inaccurate if power is lost for an extended period of time, the maximum count of 999 is reached, or the memory is corrupted by electrical interference.

- Apply power to the machine for at least 15 seconds every 48 hours to retain the formula count. See "Important Owner/User Information" for more detailed information.
- To help ensure an accurate count, record the value and clear each accumulator before it reaches 999 counts.
- If the display shows "Accumulator Error," the count for all formulas must be cleared. See the document on error messages for more information.

Display or Action	Explanation
RUN FORMULA 00 OK TO POWER OFF	This is the normal display at power-up.
▼/▲	Selects a formula by indexing forward/backward through the formula numbers (01-30).
With any formula selected,	
☑	Displays the count in the upper right corner of the display.
RUN FORMULA 038 05 FORMULA NUMBER 05	This example shows that 38 loads were processed with formula 05 since the counter was reset.
☑ + ✋	Clears the count for the selected formula.

— End of BICJUD01 —

Chapter 4
Troubleshooting

4.1. The EP-Plus Manual Menu

Document BICJHT02
Spec Date 20000831
As-of Date 20000831

4.1.1. The *Manual Menu*

4.1.1.1. Components—The *Manual menu* is made up of these selections:

1. *Software Date Code*—a display of the software type and date code, both of which are fixed in the software; and the industry type, which is determined by setting the DIP switches on the processor board.
2. *Test Inputs*—allows viewing of microprocessor inputs for testing when a formula is not running. Devices, including the door latch and the level transducer, provide signals to the microprocessor by grounding certain inputs. The status of these inputs can be monitored in this mode, and changes to the input status will appear instantaneously.
3. *Test Outputs*—allows the actuation of outputs for testing when a formula is not running. Outputs are signals from the microprocessor to other devices, such as chemical pumps and motor contactors.
4. *Test DIP Switch*—displays a hexadecimal number which is unique for each possible setting of the DIP switch. This number can be used with the appropriate tables to determine the industry configuration of the machine, as well as whether the machine is configured to allow the operator to skip certain steps during automatic operation.
5. *Test Temp and Level*—displays the pressure transducer voltage, actual level and calculated level on the top line; and the temperature sensor signal and actual temperature on the lower line. This menu selection is used with special testing equipment to calibrate the machine at the factory.

4.1.1.2. How to Access the *Manual Menu*

Display or Action	Explanation
RUN FORMULA 00 OK TO POWER OFF	The machine must be idle (power on, but not running a formula) before the *Manual menu* can be accessed. Also, the *Run/Program keyswitch* must be at the *Run* position ().
	Accesses the *Manual menu*.
MANUAL MENU 1 SOFTWARE DATE CODE	Reverse type indicates blinking cursor position. Select one of the *Manual menu* modes or return to the *Run mode*, as described below.

Display or Action	Explanation
▲ / ▼	Scrolls forward/backward through the available modes of the *Manual menu*.
↵	Returns to the *Run mode*.
RUN FORMULA 00 OK TO POWER OFF	*Run mode* selected; control is awaiting selection of a valid formula number. The formula number that was selected when the *Manual menu* was accessed appears on the display.

4.1.1.3. How to Return to the *Run Mode* from the *Manual Menu*

Display or Action	Explanation
⊞	Enters the *Manual menu* from *Run mode*.
MANUAL MENU 1 SOFTWARE DATE CODE	This is the *Manual menu* display.
↵	Exits the *Manual menu* to the *Run mode*.
RUN FORMULA 00 OK TO POWER OFF	This is the *Run mode* display. Select a formula to run, or turn off machine power.

4.1.2. Determining the Software Version

Display or Action	Explanation
⊞	Accesses the *Manual menu*.
MANUAL MENU 1 SOFTWARE DATE CODE	*Manual menu* accessed and *Software date code mode* selected.
⊞ + 1	Hold both buttons depressed to view the software date code and machine configuration information, as shown below.
EP-PLUS/H7J 97005 RESTAURANTS LAUNDRY	Machine style (H7J), software date code (97005) and configuration (Restaurants Laundry).
RUN FORMULA xx FORMULA NUMBER xx	*Run mode* display is restored when the ⊞ + 1 button combination is released.

4.1.3. Viewing Microprocessor Inputs

The on/off state of each input to the microprocessor can be displayed by using the *Test Inputs* selection of the *Manual menu*. The machine must be idle (not running a formula).

Display or Action	Explanation
⊞	Accesses the *Manual menu*.
MANUAL MENU 2 TEST INPUTS	*Manual menu* accessed and *Test Inputs* mode selected.

Display or Action	Explanation
[⊞] + [1]	Accesses the *Test Inputs* mode.
`ABCDEFGHIJKLMNOP (-)` `+--++----+----+- OFF`	The input display code on the top row corresponds to a display code in . The status of the input is displayed beneath each code. If the input is energized, a "+" appears. Non-energized inputs are represented by "–".
[↩]	Restores the controller to the *Run mode*.
`RUN FORMULA` `00 OK TO POWER OFF`	This is the *Run mode* display. Select a formula to run, or shut down the machine.

Table 6: E-P Plus Inputs

Display Code	Input Name	Connector-Pin
A	Door closed	M6-1
B	Level 1 (low level) achieved	M6-9
C	Vibration switch tripped	M6-2
D	Input from Inverter	M6-10
E	Level 2 (high level) achieved	M6-3
F	Keyswitch in Program position	M6-11
G	Input from Ampsaver	M6-4
H	Halt—external fault	M6-12
I	Halt—bath time	M6-5
J	not used	M6-13
K	not used	M6-6
L	not used	M6-14
M	not used	M6-7
N	not used	M6-15
O	not used	M6-8
P	not used	M6-16

4.1.4. Actuating Microprocessor Outputs

Machine functions may be tested individually or in groups by using the *Test Outputs* component of the *Manual menu*. The machine must be idle (not running a formula).

DANGER [21]: Crushing and Entanglement Hazard—Bare manual outputs actuate washer-extractor mechanisms. Keep all personnel clear.

Display or Action	Explanation
[⊞]	Accesses the *Manual menu*.
`MANUAL MENU` `3 TEST OUTPUTS`	This is the *Manual menu* display with the *Test Outputs* component selected.

Display or Action	Explanation
[⊞] + [1]	Accesses the output testing selection.
TEST OUTPUTS 01 INJECT CHEMICAL 5	This is the *Output testing* display.
[▲] / [▼]	Indexes forward and backward through the output names, as shown in Table 7.
TEST OUTPUTS 07 COLD WATER VALVE	Example display with output in place to be selected and subsequently actuated.
[1]	Accesses the selected output for actuation. All outputs are initially disabled when accessed.
COLD WATER VALVE 0=OFF 1=ON 0	Example display with output accessed and disabled.
[1]	Enables the output (turns the output on).
COLD WATER VALVE 0=OFF 1=ON 1	Example display with output enabled. The cold water valve is open.
[1]	If the output was already on, this keystroke turns it off.
COLD WATER VALVE 0=OFF 1=ON 0	Example display with output disabled. The cold water valve is closed.
[▲]	Disables (turns off) the output if it was previously enabled, and advances to the next output.
HOT WATER VALVE 0=OFF 1=ON 0	Display after pressing [▲] to advance to the next output.
[⏻]	Disables the output if it was enabled, then returns to the *Run mode*.
RUN FORMULA 00 OK TO POWER OFF	Display of *Run mode*.

Table 7: E-P Plus Outputs

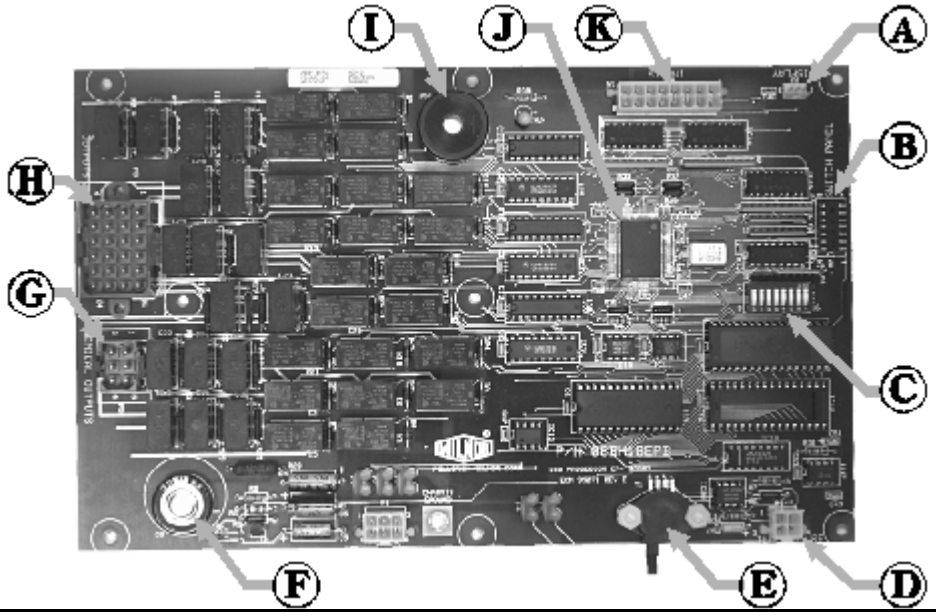
Output Number	Description	Device	Consequences of Actuation
1	Inject chemical 5	K1	Operates inject device for chemical 5
2	Inject chemical 1	K2	Operates inject device for chemical 1
3	Inject chemical 4	K3	Operates inject device for chemical 4
4	Inject chemical 3	K4	Operates inject device for chemical 3
5	Inject chemical 2	K5	Operates inject device for chemical 2
6	Hot water valve	K6	Opens valve
7	Cold water valve	K7	Opens valve
8	Drain solenoid	K8	Closes drain
9	Flush valve	K9	Opens flush valve
10	Cooldown (if equipped)	K10	Operates cooldown valve, if equipped
11	Extra water (if equipped)	K11	Operates extra water valve, if equipped
12	Reuse drain (if equipped)	K12	Operates reuse drain, if equipped
13	Steam (if equipped)	K13	Operates steam valve, if equipped
14	not used	K14	
15	not used	K15	
16	Door interlock	K16	Energizes door latch to locked position
17	Unlock door	K17	Energizes door latch to unlocked position
18	Wash clutch	K18	Engages wash clutch
19	Extract speed (use only with empty cylinder)	K19	Locks door, releases brake (if any), and turns cylinder at extract speed.
20	Distribution (drain) speed (Door must be closed)	K20	Locks door, releases brake (if any), and turns cylinder at drain speed.
21	Clockwise wash speed (Door must be closed)	K21	Locks door, releases brake (if any), and turns cylinder clockwise at wash speed.
22	Counter-clockwise wash speed (Door must be closed)	K22	Locks door, releases brake (if any), and turns cylinder counter-clockwise at wash speed.
23	Buzz signal	Board-mounted signal	Sounds operator alarm
24	Run light	Board-mounted light	Turns on light in Start button (1)
25	Reversing wash speed	Functional test	Locks door and reverses cylinder at wash speed.
26	High extract speed	Functional test	Locks door and turns cylinder clockwise at wash speed, then high extract speed.
27	Fill to level 1	Functional test	Locks door, closes drain, fills to level 1 with cold water.
28	Fill to level 2	Functional test	Locks door, closes drain, fills to level 2 with cold water.

4.1.5. Testing and Verifying the DIP Switch Settings

For all HxJ machines, the set of default formulas is determined by how the DIP switches on the processor board are set. The bank of DIP switches is identified in Figure 5.

Figure 5: HxJ Processor Board

Processor Board



Legend

- **A.** Display connector
- **B.** Switch panel connector
- **C.** DIP switches
- **D.** Temperature probe connector
- **E.** Pressure transducer for level
- **F.** Capacitor to retain memory
- **G.** Outputs to chemical pumps
- **H.** Standard outputs
- **I.** Operator signal buzzer
- **J.** CPU chip
- **K.** Input connector

There is one unique number which identifies each possible combination of on/off settings at the DIP switch. While the industry configuration (switch 1 through switch 4) is readily available from the *Software version mode* (described in section 4.1.2 Determining the Software Version), the settings of other switch positions are only apparent from this display or by visually inspecting the processor board.

Display or Action	Explanation
[Menu]	Enters the *Manual menu* from the *Run mode*.
`MANUAL MENU` `1 SOFTWARE DATE CODE`	This is the first item of the *Manual menu*.
[▼], [▼]	Scrolls down to the *Test DIP Switch* item.
`MANUAL MENU` `4 TEST DIP SWITCH`	This is the *Test DIP Switch* item of the *Manual menu*.
[Menu] + [1]	Accesses the *Test DIP Switch* function and displays the DIP switch setting.
`052`	This is an example of the DIP switch display. Referencing this number in Table 8 shows that the sample machine is configured for Restaurants Laundry, and that switch positions 5 and 6 are enabled.
[Exit]	Terminates the *Manual menu* and returns controller to *Run mode*.

Table 8: Interpretation of *Test DIP Switch* Display

Industry Configuration	Standard Display Value	Value if Position 5 is ON	Value if Position 6 is ON	Value if Both Positions 5 and 6 are ON
Correctional	0	16	32	48
Hotel/Motel	1	17	33	49
Athletic	2	18	34	50
Healthcare	3	19	35	51
Restaurants	4	20	36	52
Commercial	5	21	37	53
Shirt Laundry	6	22	38	54
Offshore	7	23	39	55
Fire-Fighter	8	24	40	56

4.1.6. Testing Temperature and Level Sensors

The *Test Temperature & Level* selection on the *Manual menu* is designed primarily for use by the Milnor® factory for testing and calibration of machines before delivery. The display is explained briefly here, as special testing equipment is required to make adjustments from this display.

Display or Action

```
R00088 A:01.0 C:01.0
R00099 A:082F [TEMP]
```

Explanation

The top line of the display applies to the level sensing circuit. The "R" and the five characters immediately following it on the top line indicate the voltage being delivered by the pressure transducer on the processor board (see Figure 5). The "A" value is the actual instantaneous level read by the transducer. Because this display is only available when the drain is open, the actual level will normally reflect no water in the machine cylinder. The "C" value is a calculated average of the transducer levels, used to negate the effects of rising and falling water levels caused by the reversing wash motion. Again, in normal conditions, this value will reflect that there is no water in the machine.

The bottom line of the display applies to the temperature sensing circuit. Similar to the "R" value of the top line, the first six characters of the bottom line indicate the voltage being delivered by the temperature probe to the processor board (see Figure 5). The "A" value on the bottom line is the temperature in degrees Fahrenheit detected by the temperature probe.

— End of BICJHT02 —

4.2. Error Messages

Document.....BICJHT01
Spec Date 20000831
As-of Date 20000831

4.2.1. Error Messages at Power Up

If an error message appears during power up, the error must be cleared before the machine can be run or programmed.

Display or Action	Explanation
ACCUMULATOR ERROR TERMINATE TO CLEAR	The microprocessor performs a memory check each time the machine is turned on. This error message appears if the microprocessor detects that the accumulator data is corrupt, in which case all accumulators must be reset to zero.
	Resets all accumulators and clears the error message. See "Viewing and Clearing the Formula Count Accumulator" (see Table of Contents) for more information.
CHECKSUM ERROR, TURN KEY TO PROGRAM	Appears if there is illegal data in the configuration, formula, or industry memory areas. Use the following procedure to clear this error.

1. Reconfigure the machine according to the configuration information in "Programming the E-P Plus® Control" (see Table of Contents).
2. Reinstall the standard (default) formulas according to the default formula loading procedure in "Programming the E-P Plus® Control".
3. Reprogram any lost wash formulas according to "Programming the E-P Plus® Control".

MEMORY: FLASH IS NOT TALKING	This message appears when the microprocessor cannot read from the flash memory.

1. Lock off and tag out power to the machine.
2. Replace flash memory. Contact the Milnor® factory to ensure that the replacement memory is the most current version for your machine.
3. Restore power to machine.
4. Reconfigure the machine according to the configuration information in "Programming the E-P Plus® Control" (see Table of Contents).
5. Reinstall the standard (default) formulas according to the default formula loading procedure in "Programming the E-P Plus® Control".
6. Reprogram lost wash formulas according to "Programming the E-P Plus® Control".

A/D BOARD IS NOT TALKING	This error message indicates that the analog to digital board is not communicating with the microprocessor.

1. Lock off and tag out power to the machine.
2. Check the connections at both ends of the ribbon cable between the processor board and the analog to digital board.
3. Restore power.
4. If the error persists, lock off and tag out power to the machine. Have a qualified service technician replace the the suspect board.

4.2.2. Error Messages during Normal Operation

If an error message appears on the bottom line of the display while the machine is running, the timer shown on the top line will stop counting. When the error is corrected, the timer resumes counting down. To troubleshoot most errors, suspend the formula in progress and turn power off. Do not terminate the formula if it is to be resumed after the error is corrected. See "Running a Formula" for more information.

Display or Action	Explanation
DOOR NOT CLOSED	This error message indicates that the door input is not made while the machine is running. Verify that the door is closed, then check the door switch and its connection to the microprocessor. Press [1] if necessary to resume operation after the error is corrected. **Never operate this machine while this message is present.**
CHECK LEVEL SWITCH	The level switch may be faulty, perhaps reporting that level 2 was achieved before level 1. Check the level switch and its input connection to the microprocessor.
LEVELS STILL MADE	The microprocessor is still receiving information that a level is made just before or during an extract step, or immediately before the fill for a bath step. This error is self-clearing when level is lost.
TOO LONG TO FILL	Time to fill to level exceeded 10 minutes. Check the water valves, strainers, supply lines, and water pressure. The machine will continue to fill until level is reached, at which time the error will automatically clear and normal operation will resume.
TOO LONG TO STEAM	The configured maximum time to steam up to the desired temperature has been exceeded. Check the steam valve, strainer, main steam header and pressure, etc. Steaming will continue until temperature is achieved, when the error will automatically clear and normal operation will resume.
TOO LONG TO COOL	The configured maximum time to cool down to the desired temperature has been exceeded. Check the cooldown valve and strainer if equipped, cold water pressure, and position of vernier valve on cooldown inlet. Cooldown will continue until the desired temperature is achieved, when the error will automatically clear.
TOO LONG TO DRAIN	The machine did not drain properly in the allotted drain time. This self-correcting error will clear when the water level in the basket is low enough to begin the next operation.
CHECK PROBE	This error message indicates that the resistance of the temperature probe is outside the specified range. Test the probe by disconnecting the probe leads from the processor board and checking the resistance with an accurate digital ohmmeter. Resistance between the two leads must be between 2K and 35K Ohms. Resistance between each lead and ground must be infinite.
EXTERNAL FAULT	The programmed chemical injection failed, usually because the chemical supply system is empty. When chemicals are added and can be injected, this error will clear automatically, allowing operation to resume.
INVERTER FAULT	This error message appears if the microprocessor does not receive an input from the inverter within 14 seconds of the beginning of the formula. After 14 seconds without an inverter input, the timer stops, the basket is stationary, and the drain valve opens. To recover, press the Next key ([☑]).

Display or Action	Explanation
VIBRATION SW TRIPPED RECOVERY SEQUENCE	When the vibration switch closes, the timer stops. After 80 seconds, the basket reverses at wash speed as the cylinder fills with water. When low level is achieved, the cylinder reverses for one additional minute at wash speed, then accelerates to extract speed.

— End of BICJHT01 —

Chapter 5
Supplemental Information

5.1. The E-P Plus Hardware

Document BICJUF01
Spec Date 20000831
As-of Date 20000831

The Milnor® E-P Plus® microprocessor control is designed specifically for Milnor® washer-extractors. Along with certain external electromechanical relay logic and sensing devices, it controls all machine and system functions. Not every microprocessor system includes all the following components.

5.1.1. Keyswitches

5.1.1.1. Run/Program Keyswitch—This keyswitch allows controlling who has the necessary access to modify wash formulas. Formulas can be modified only when this switch is turned from the *Run* position ( ) to the *Program* position ( ). To safeguard wash formulas, keep this key in a secure place with restricted personnel access.

5.1.1.2. Automatic/Test Keyswitch—This keyswitch allows controlling who has the necessary access to operate the machine in *Test mode* for troubleshooting. *Test mode* can only be accessed when this switch is turned from the *Automatic* position ( ) to the *Test* position ( ). To reduce the risk of personal injury and machine damage, keep this key in a secure place with restricted personnel access.

5.1.2. Display

Machines in the FxJ and HxJ model lines, as well as the 30015 and 30022VxJ models, use a vacuum fluorescent display consisting of two lines of 20 characters each. This type of display is easily identified by green characters on a black background when operating, or a nearly black background when not operating.

5.1.3. Power Supply

The power supply serves to provide a regulated specific voltage to the processor board and certain auxiliary boards and devices. It converts control circuit alternating current voltage to +12 volts direct current, –12 volts direct current, and +5 volts direct current. The power supply is switchable between 120 volts and 240 volts alternating current input voltage.

Although the +12VDC and –12VDC are not adjustable, the +5VDC is rather sensitive and the power supply must be adjusted so **the actual voltage *at the processor board* is between 5.04VDC and 5.06VDC** as measured by an accurate digital voltmeter. If this voltage is not within the stated range, the machine is likely to malfunction.

5.1.4. CPU Processor Board

The central processing unit (CPU) processes data received from the various inputs, stores information, and responds to each pushbutton entry with the appropriate action. Data is stored in one or more of the following types of memory chips on the CPU board, depending on the machine model.

SRAM—Static Random Access Memory stores the accumulator (formula count) data as long as the machine has power, or via a capacitor for approximately 24 hours with power off. This type of component is also used to retain the last formula and step in progress when power is turned off at the machine while a formula is running. SRAM is used in all E-P Plus® controllers.

Flash Memory—similar to EEPROM memory in function, flash memory can be electrically erased and reprogrammed, but is faster and can retain more data than EEPROM memory. Flash memory is used only on 188 processor boards (those used in HxJ, T5J, and 30015 and 30022VxJ models). The two flash memory chips reside in sockets IC2 and IC12. The chip in socket IC12 contains operating instructions and the complete set of industry standard formulas. As software updates are made available, this chip will be replaced. The chip in socket IC2 holds the industry formulas and user changes to those formulas, as well as machine configuration data. The chip in socket IC2 will not normally need replacing for software updates.

5.1.5. Outputs

Depending on the processor board, output relays may be either socket-mounted to a separate output board, or permanently soldered to the processor board. HxJ, TxJ, and 30015 and 30022VxJ models use the 188 processor board with soldered relays.

For models other than the HxJ, TxJ, and 30015 and 30022VxJ, the 16 output relays are socket-mounted SPDT electromechanical relays with contacts capable of faithfully conducting a maximum of 25VA (0.1 ampere (100 millliamperes) at 220/240VAC, or 0.2 amperes (200 milliamperes) at a maximum of 110/120VAC). The output voltage will be either 220/240VAC or 110/120VAC, depending on machine model and type.

These outputs and their power source are intended only to drive another relay with higher contact ratings that may, in turn, drive a pump, valve, solenoid, etc. from a separate power source. Never use these outputs to directly drive a pump, valve, or solenoid unless the maximum current required never exceeds the above values. Higher ampere or VA loads will burn out traces on the printed circuit board or possibly overload and damage the control circuit transformer.

Machines in the HxJ, TxJ, and 30015 and 30022VxJ model lines use the 188 processor board with output relays soldered to the processor board. These relays have the same load parameters as those used in other models, but are SPST (single pole, single throw) rather than the SPDT (single pole, double throw) relays used on the 788 board.

WARNING 22: Avoid damage to electronic boards—Although the relays on 188 processor boards are capable of handling higher loads, failure to restrict current loads to the values stated above may cause traces on the processor board to fail, thus destroying the board.

5.1.6. Option Outputs

The 188 E-P Plus® processor board used in HxJ, TxJ, and 30015 and 30022VxJ models includes the option output relays as well as the standard output relays directly on the board. All 22 of the output relays on the 188 processor board are identical.

5.1.7. Analog to Digital Convertor

This component converts analog signals, such as from the temperature probe, to a digital signal that can be used by the microprocessor. The A/D convertor is a part of the 188 processor board used in HxJ, TxJ, and 30015 and 30022VxJ models. The A/D convertor also provides a fixed voltage which is used as a reference for sensing temperature.

5.1.8. Temperature Probe

A thermistor temperature probe is provided in the machine sump if the machine is equiped for optional temperature control. This probe is a resistor that changes value according to temperature.

5.1.9. Pressure Sensor

The 188 E-P Plus® processor board, used in all HxJ, TxJ, and 30015 and 30022VxJ models, contains a pressure transducer unit mounted directly to the board. This transducer produces a very small voltage that increases as the water level in the basket rises.

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